

How to assess modeling studies

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Is the overall study sound?

- Does the study address an important/interesting question?
- Does a model make sense for the question being addressed?



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Model assumptions and complexity

- Are the assumptions made in building the model clearly described and justified?
- Does the model have the right level of detail given the question and data?
- If the model is simple, does it include details important for the question?
- If the model is complex, are the model parameter values well supported by available data?



Model implementation

- Is the model properly implemented and well described?
- Are diagrams and equations (if applicable) shown?
- Are enough details provided that someone could re-implement their model?
- Is the model code freely available?

Model use

- What is the model used for, and is that clearly explained?
- Is a thorough analysis performed?
- If the model is used for prediction, is some type of uncertainty and sensitivity analysis included?
- If the model is fit to data, are there checks for overfitting?

Model results

- How generalizable are the results?
- Do the authors discuss when/how the model *fails* and what that means?
This is often informative.
- If the model 'works', do the authors discuss why/how?

Model checks/validation

- If there was no fitting of data, do the authors compare model results to data?
 - What kind of comparison is done?
 - Is the comparison convincing?



Model interpretation

- Are claims consistent with methods and results?
 - A very simple model is likely not suitable for detailed predictions.
 - A complicated model is likely not reliable if the model inputs have lots of uncertainty or the model assumptions are not acceptable.
- If model use is exploratory/qualitative, are authors clear about this?
- If model is meant to predict, are levels of uncertainty provided? What kind of uncertainty is considered?

Summary

- Simulation models are useful tools to study infectious diseases.
- Models are not a magic tool. Results are only as good/reliable as the quality of the underlying model.
- If in doubt about the quality/reliability of a modeling study, ask an expert.

Literature

- Basu and Andrews, "Complexity in Mathematical Models of Public Health Policies: A Guide for Consumers of Models", doi:10.1371/journal.pmed.1001540
- Garnett et al, "Mathematical models in the evaluation of health programmes", doi:10.1016/S0140-6736(10)61505-X